Petaluma Valley Groundwater Basin

Groundwater Basin Number: 2-1

County: Marin, Sonoma

Surface Area: 46,000 acres (70 square miles)

Basin Boundaries and Hydrology

The Petaluma Valley occupies a structural depression in the Coast Ranges immediately north of San Pablo Bay. The valley extends from the bay northward to a series of low hills near the town of Penngrove. It is bounded on the west by the Mendocino Range and on the east by the Sonoma Mountains. Northwest trending folds and a few faults are the most important geologic structures of the Petaluma Valley (Cardwell 1958).

The Petaluma River is the principal stream draining the Petaluma Valley. It is tidally influenced from the town of Petaluma downstream to its mouth at San Pablo Bay. Flow in the reach above tidewater is seasonal, beginning in the period October to December and continuing through the following June (Cardwell 1958). Precipitation averages 24 to 28 inches in the valley and ranges to 40 inches in highland areas to the extreme northeast within the drainage basin of the valley.

Hydrogeologic Information

Water Bearing Formations

The Petaluma Valley groundwater basin is comprised of late Tertiary to Quaternary age sedimentary deposits of marine and continental origin and volcanic rocks (Cardwell 1958). The younger alluvium, older alluvium, and Merced formation are the major water bearing units. The Petaluma formation typically has low yields and the Sonoma Volcanics has highly variable yields (DWR 1982).

Younger Alluvium. The younger alluvium is of Holocene age and forms alluvial fan deposits at the margin of the valley, which spreads out to cover the valley troughs in a relatively thin layer. These deposits lay unconformably on the older alluvium and are formed by aggradation along streams, sheet wash and other colluvial processes. The material is chiefly fine grained, composed of silt, sandy-clay, some sand and scattered thin beds of gravel. The permeability of the younger alluvium is low because of the fine-grained nature of the deposits. Specific yields for the younger alluvium are variable ranging from 3-15 % (DWR 1982).

Well yields range from 50 to 150 gpm (Cardwell 1958). Maximum thickness of the younger alluvium occurs

in the southeastern portion of the valley where it is perhaps 300 feet (Cardwell 1958). Seawater intrusion degrades water quality in this aquifer in the southern Petaluma Valley and the tidal portion of the Petaluma River (DWR 1982).

Older Alluvium. The older alluvium is probably of late Pleistocene age and, where exposed, consists principally of alluvial fan deposits. The older alluvium is exposed in the northeastern portion of the valley but extends west and southwest across the valley beneath the younger alluvium. It consists of unconsolidated, poorly sorted sand and sandy gravel interbedded with silt and silty clay. This unit can be less than 100 to more than 200 feet in thickness and is essentially unconfined. The older alluvium is of principal importance as an aquifer in northern portion of the Petaluma Valley where it supplies water to wells of intermediate depth. Yields range from 20-200 gpm. Specific yield for this unit is moderate to high ranging between 8 and 17 % (DWR 1982). Specific capacities range from less than 1 to 5 gpm per foot of drawdown (Cardwell 1958). Water quality is good for most uses.

Merced Formation. The Merced formation is one of the most important water-bearing formations in the Petaluma Valley. It crops out along the northwestern and southeastern margins of the basin. The Merced formation is tapped by deeper wells near the center and southern portion of the basin. The Merced formation is late Pliocene to possibly early Pleistocene age. It ranges in thickness from 300 to 2000 feet. It consists of massive beds of fine marine sand and sandstone, and has interbeds of clay, silty clay, and gravel. The specific yield for the Merced formation is high with a range from 10-20%. The Merced has a high porosity but only a moderate transmissibility due to the small fraction of coarse material. The Merced is known to be confined in the northern portion of the Petaluma Valley and is likely confined in other places. The yields of wells in the Merced formation range from 100-1500 gpm. Specific capacities range from 2-30 gpm per foot of drawdown. Wells are commonly drilled to depths of 200-600 feet to obtain these yields (Cardwell 1958). The quality of water in the Merced formation is satisfactory for most uses although locally near the bay, water in the Merced may be brackish.

Sonoma Volcanics. The Sonoma Volcanics of Pliocene age is exposed in the upland area along the northeastern portion of the valley. The Sonoma volcanics form only a small part of the groundwater reservoir in the Petaluma Valley. Locally they supply moderate yields to a few wells probably from tuff and fractured andesite. South of Penngrove is the principal area where wells penetrate volcanic rock. Volcanic rocks are generally not encountered in wells beneath the alluvial plain (Cardwell 1958). The Sonoma volcanics has a highly variable specific yield and has been assigned a specific yield of 0 to 15 percent (DWR 1982). The quality of the water obtained from the Sonoma volcanics is satisfactory for most uses.

Petaluma Formation. The Petaluma formation is exposed in 1-2 mile belt along the northeastern margin of the Petaluma Valley. It is mid to late Pliocene in age and is estimated to be as much as 4000 feet thick. The Petaluma formation mostly (70%) consists of poorly stratified clay of continental and marine origin. The Petaluma formation is an important water-bearing formation only in the northern part of the Petaluma Valley where it supplies wells at the northeastern edge of the valley. The water occurs in lenses of sand or poorly consolidated sandstone separated by clay layers. Yields vary with the thickness and extent of the sands encountered in the well and are generally low. Well yields are usually sufficient only for domestic use (Cardwell 1958).

Recharge Areas

The groundwater in the Petaluma Valley is recharged in most part by the deep infiltration of rainfall. Suitable recharge areas, those with slopes less than 15 percent and sufficiently permeable are concentrated northwest of Petaluma and also are scattered on the western flank of the Sonoma Mountains to the east. The rate of recharge is generally slow, depending on the annual precipitation (DWR 1982).

Groundwater Level Trends

Ground water levels near the city of Petaluma dropped from the mid-1950's until the early 1960's. Seawater intrusion occurred in the alluvial fan deposits along the Petaluma River as a result of ground water pumping. Ground water levels began to recover after water was imported from the Russian River in 1962. In some cases ground water levels have returned to historic high levels. Ground water levels in monitored wells normally fluctuate10 feet between spring and fall. Ground water levels have remained steady since that time with the exception of the 1976-1977 drought, during which time water levels dropped an average of 10 feet below the normal yearly low. In most cases levels had returned to normal by spring 1978. Generally, hydrographs indicate the volume of water stored in the Petaluma Valley has not changed much over time (DWR 1982).

Groundwater Storage

Groundwater Storage Capacity. In California Department of Water Resources, Bulletin 118-4, *Evaluation of Ground Water Resources Sonoma County Volume 3: Petaluma Valley* published June 1982 the total storage capacity for the study area was estimated to be 1,697,000 ac-ft. It must be noted that the groundwater basin as defined in Bulletin 118-4 encompassed an area of 60,000 acres. Portions of this study area are now included in the Wilson Grove Formation Highlands groundwater basin and the Napa Sonoma

Volcanic highlands groundwater basin. As presently defined, the Petaluma Valley groundwater basin contains 46,000 acres. Total storage capacity will therefore be less than this reported figure.

Groundwater in Storage. Total ground water in storage was estimated to be 1,420,000 ac-ft in DWR's, Bulletin 118-4. As noted in the section on groundwater storage capacity, re-definition of Petaluma groundwater basin boundary has reduced its areal extent. This will result in a reduction in the volume of groundwater in storage.

Groundwater Quality

Characterization. Groundwater quality varies considerably within the Petaluma Valley due to the general discontinuous nature of the water bearing formations, which results in a number of isolated ground water bodies (DWR 1982). The sands and gravels of the Merced formation are the exception to this. Water from the hills west of Petaluma is calcium bicarbonate chloride type. Wells beneath the valley floor east of Petaluma produce sodium bicarbonate water. Wells in intermediate geographic locations produce water that is midway in quality between the Merced of the hills and the Merced underlying the valley, indicating some degree of aquifer continuity (DWR 1982). Water of the Petaluma formation varies considerably. Since the Petaluma is a marine formation it frequently contains highly mineralized connate water (DWR 1982).

Impairments. There is widespread and serious nitrate contamination affecting shallow wells in the upland area northwest of Petaluma. This appears to be the result of large amounts of animal wastes dumped on the permeable soils in this area. The upper 50 feet is generally affected. Hydrologic conditions in this upland area will allow for the continued spread of this polluted water. Continued use of this resource is possible as long as the wells are of sufficient depth and adequately sealed to prevent near surface contamination from entering the wells (DWR 1982). Generally there is poor quality groundwater in the Petaluma Valley south of Petaluma. The potential for renewed seawater intrusion exists in the tidal reaches near the Petaluma River if groundwater extraction were to increase to historically high levels (DWR 1982). There is an increasing problem with MTBE contamination. Two wells within the county have already been shut down. (Hodge 2000).

Groundwater Budget (Type C)

Not enough data exists presently to provide either an estimate of the basin's groundwater budget or the groundwater extraction from the basin. The natural recharge was estimated to be 40,000 ac-ft in California Department of Water Resources, Bulletin 118-4, *Evaluation of Ground Water Resources Sonoma County*

Volume 3: Petaluma Valley published June 1982. This estimate was based on an area of 60,000 acres. Currently the Petaluma Valley groundwater basin encompasses 46,000 acres. Artificial recharge has not been considered in this basin, as natural recharge exceeds the storage capacity (DWR 1982).

Well Production Characteristics

Well Yields: (gal/min)	City of Petaluma: Range: 60 – 100 Average: (Hodge 2000). USGS Range: 50 – 1500 Average: (Cardwell 1958).
Production Depths: (ft)	Total depths of completed wells Domestic: Range: 30 - 516 Average: 247 (89 Well Completion Reports) Municipal/Irrigation: Range: 145 - 750 Average: 496 (8 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of Wells /Measurement Frequency
DWR (including cooperators)	Groundwater levels	13 wells semi-annually, 3 monthly
DWR (including cooperators)	Mineral, nutrient, and minor element	7 wells every two years
Department of Health Services and cooperators	Title 22 water quality	24 wells

Basin Management

Groundwater Management:	
Water Agencies: Public Private	Sonoma County Water Agency, North Marin Water District, City of Petaluma

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References Cited

Cardwell,G.T. 1958. *Geology and Groundwater in the Santa Rosa and Petaluma Valley Areas, Sonoma County California.* US geological Survey Water-Supply Paper 1427.

California Department of Water Resources. 1982. *Evaluation of groundwater resources, Sonoma County, Volume 3: Petaluma Valley* Bulletin 118-4.

Hodge, Lou (City of Petaluma, Water Assistance Supervisor). Personal Communication, October 18, 2000